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| 09/677,558 | 09/29/2000 | Gi-Young Jeun | 29347/990488 | 1618 |

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| EXAMINER |
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NGUYEN, DILINH P

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| ART UNIT | PAPER NUMBER |
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2814

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08/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 09/677,558 | JEUN ET AL. | |
| | Examiner | Art Unit | |
| | DiLinh Nguyen | 2814 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 8-11 and 19-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8-11 and 19-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-2, 4, 10-11 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ohno et al. (U.S. Pat. 5227662).

- Regarding claims 1 and 21-22, Hamzehdoost et al. discloses a semiconductor package comprising:

- a lead frame having a first portion 152 at a first level, a second portion connected to the first portion at a second level, and a plurality of terminals connected to the second portion;

- a power circuit 150 mounted on a first surface of the first portion;

- a heat sink 130 having an electrically insulating property and thermal conductivity [the heat sink 130 is formed of an aluminum nitride material] (cover fig., column 6, lines 23-24), wherein the heat sink directly contacts a second surface opposite the first surface of the first portion of the lead frame; and

- a sealer having an electrically insulating property and thermal conductivity, wherein the sealer covers the power circuit (cover fig.).

Hamzehdoost et al. do not disclose a surface of the heat sink is exposed to the outside of the semiconductor power module.

However, Ohno et al. disclose a semiconductor power module comprising: a heat sink 40, the heat sink comprising at least one compound selected from the group consisting of AlN (cover fig., column 5, lines 43-45) and wherein a surface of the heat sink 40 is exposed to the outside of the semiconductor module (cover fig., column 5, lines 38-44). Therefore, it would have been obvious to one having ordinary in the art at the time the invention was made to modify the device structure of Hamzehdoost et al. by having a surface of the heat sink is exposed to the outside of the semiconductor power module because as taught by Ohno et al., such exposing the surface of the heat sink from the sealing member is a well known process for providing a good heat dissipation for the semiconductor package (cover fig.).

- Regarding claim 2, Hamzehdoost et al. discloses that the first portion of the lead frame is centrally positioned within the lead frame (fig. 14A).
- Regarding claim 4, Hamzehdoost et al. discloses that the first surface of the first portion is a top surface and wherein the second surface of the first portion is a bottom surface (fig. 14A).
- Regarding claim 10, Hamzehdoost et al. discloses that the heat sink and the sealer each have grooves 132 and wherein the heat sink and the sealer are connected to each other by means of the grooves (cover fig.).
- Regarding claim 11, Hamzehdoost et al. discloses that the heat sink 130 is sheet-shaped (cover fig. and fig. 14A).

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3. Claims 3, 5 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ohno et al. (U.S. Pat. 5227662) as applied to claim 1 above, and further in view of Majumdar et al. (U.S. Pat. 5703399).

- Regarding claims 3 and 5, Hamzehdoost et al. in view of Ohno et al. substantially discloses all the limitations as claimed above except for the package comprising a power semiconductor element and a control circuit that drives the power circuit.

However, Majumdar et al. disclose that a lead frame 3 having a first portion at a first level, a second portion surrounding the first portion at a second level, and a plurality of terminals 15 and 17 connected to the second portion;

a power circuit 9 includes a power semiconductor element 4a; and

a control circuit 8 that drives the power circuit (fig. 9, column 7, lines 10-25).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Hamzehdoost et al. in view of Ohno et al. by having a power semiconductor element and a control circuit that drives the power circuit, as taught by Majumdar et al., such the power element and control circuit would enhance the noise resistance and control the operation of the power circuit (column 7, lines 10-12).

- Regarding claim 11, Majumdar et al. disclose that the heat sink 1 is sheet-shaped (fig. 9).

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ohno et al. (U.S. Pat. 5227662) as applied to claim 1 above, and further in view of McCarthy et al. (U.S. Pat. 3956726).

Hamzehdoost et al. in view of Ohno et al. substantially discloses all the limitations as claimed above except the module further comprising a heat detection circuit.

However, McCarthy et al. disclose a device comprising a heat detection circuit (column 1, lines 39-42). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Hamzehdoost et al. in view of Ohno et al. by having a heat detection circuit because as taught by McCarthy et al., such the heat detection circuit would detect the heat produced by the semiconductor element for the package device (column 1, lines 39-42).

5. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ohno et al. (U.S. Pat. 5227662) as applied to claim 1 above and further in view of Tomita et al. (U.S. Pat. 5440169).

Hamzehdoost et al. in view of Ohno et al. substantially discloses all the limitations as claimed above except the heat sink is adhered to at least one of the lead frame and the sealer with an adhesive.

However, Tomita et al. disclose a heat sink 30 is adhered to at least one of the lead frame and a sealer 6 with an adhesive of a plurality of dimples 25 (fig. 8, column 5, lines 35-60). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Hamzehdoost et al. in view of Ohno et al. by having the heat sink is adhered to the lead frame and the sealer with an adhesive, as taught by Tomita et al., in order to improve the molding characteristics for the semiconductor package (column 5, lines 60 et seq.).

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6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) and Ohno et al. (U.S. Pat. 5227662) in view of Tomita et al. (U.S. Pat. 5440169) as applied to claims 1 and 8 above, and further in view of Majumdar et al. (U.S. Pat. 5703399).

As discussed in details above, the combination of Hamzehdoost et al., Ohno et al. and Tomita et al. substantially disclose all the limitations as claimed above except the adhesive contains a filler that includes at least one compound selected from the group consisting of Al_2O_3 , AlN and BeO.

However, Majumdar et al. disclose a highly heat conducting resin 2, wherein the adhesive contains a filler that includes at least one compound selected from the group consisting of AlN (column 8, lines 22-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to select AlN for the filler in the adhesive of the above combination because as taught by Majumdar et al., such the filler in the adhesive would provide a highly heat conducting resin with an excellent electric insulating property and thermal conductivity (column 8, lines 25-34).

7. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ohno et al. (U.S. Pat. 5227662).

Hamzehdoost et al. discloses a semiconductor package comprising:

a lead frame having a first portion 152 at a first level, a second portion connected to the first portion at a second level, and a plurality of terminals connected to the second portion;

a power circuit 150 mounted on a first surface of the first portion;

a heat sink 130 having an electrically insulating property and thermal conductivity (column 6, lines 23-26), wherein the heat sink directly contacts a second surface opposite the first surface of the first portion of the lead frame; and

a sealer having an electrically insulating property and thermal conductivity, wherein the sealer covers the power circuit (cover fig.)

Hamzehdoost et al. do not explicitly disclose that the heat sink comprising at least one compound selected from the group consisting of Al_2O_3 or comprising BeO . However, Hamzehdoost et al. disclose that the heat sink 130 is formed of an aluminum nitride material, although any of the numerous other similar ceramic-type substrate materials well known in the art are suitable (column 6, lines 23-26). Moreover, selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Hamzehdoost et al. do not disclose a surface of the heat sink is exposed to the outside of the semiconductor power module.

However, Ohno et al. disclose a semiconductor power module comprising: a heat sink 40, the heat sink having an electrically insulating property and thermal conductivity [AlN] (cover fig., column 5, lines 43-45) and wherein a surface of the heat sink 40 is exposed to the outside of the semiconductor module (cover fig., column 5, lines 38-44). Therefore, it would have been obvious to one having ordinary in the art at the time the invention was made to modify the device structure of Hamzehdoost et al. by having a surface of the heat sink is exposed to the outside of the semiconductor power module

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because as taught by Ohno et al., such exposing the surface of the heat sink from the sealing member is a well known process for providing a good heat dissipation for the semiconductor package (cover fig.).

8. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Tanaka et al. (U.S. Pat. 5258649) and further in view of Ohno et al. (U.S. Pat. 5227662).

Hamzehdoost et al. discloses a semiconductor package comprising:

a lead frame having a first portion 152 at a first level, a second portion connected to the first portion at a second level, and a plurality of terminals connected to the second portion;

a power circuit 150 mounted on a first surface of the first portion;

a heat sink 130 having an electrically insulating property and thermal conductivity (column 6, lines 23-26), wherein the heat sink directly contacts a second surface opposite the first surface of the first portion of the lead frame; and

a sealer having an electrically insulating property and thermal conductivity, wherein the sealer covers the power circuit (cover fig.)

Hamzehdoost et al. do not explicitly disclose that the heat sink consisting of Al_2O_3 or at least one compound comprising BeO and a surface of the heat sink is exposed to the outside of the semiconductor power module.

However, Tanaka et al. disclose a semiconductor device comprising a heat sink comprising at least one compound selected from the group consisting of aluminum oxide, aluminum nitride, and a beryllium oxide etc (column 6, lines 11-15) in order to

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select of a known material for forming the heat sink based on its suitability for its intended use.

Ohno et al. disclose a semiconductor power module comprising: a heat sink 40, the heat sink having an electrically insulating property and thermal conductivity [AlN] (cover fig., column 5, lines 43-45) and wherein a surface of the heat sink 40 is exposed to the outside of the semiconductor module (cover fig., column 5, lines 38-44) in order to provide good heat dissipation for the semiconductor package device (cover fig.).

Therefore, it would have been obvious to one having ordinary in the art at the time the invention was made to modify the device structure of Hamzehdoost et al. by having the aluminum oxide or the beryllium oxide heat sink and a surface of the heat sink is exposed to the outside of the semiconductor power module because as taught by Tanaka et al. and Ohno et al., in order to select of a known material for forming the heat sink based on its suitability for its intended use and exposing the surface of the heat sink from the sealing member is a well known process for providing a good heat dissipation for the semiconductor package (cover fig.).

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hamzehdoost et al. (U.S. Pat. 5430331) in view of Ikeda et al. (U.S. Pat. 5635751) and further in view of Ohno et al. (U.S. Pat. 5227662).

Hamzehdoost et al. discloses a semiconductor package comprising:

a lead frame having a first portion 152 at a first level, a second portion connected to the first portion at a second level, and a plurality of terminals connected to the second portion;

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a power circuit 150 mounted on a first surface of the first portion;

a heat sink 130 having an electrically insulating property and thermal conductivity (column 6, lines 23-26), wherein the heat sink directly contacts a second surface opposite the first surface of the first portion of the lead frame; and

a sealer having an electrically insulating property and thermal conductivity, wherein the sealer covers the power circuit (cover fig.)

Hamzehddoost et al. do not explicitly disclose the heat sink comprising at least one compound comprising BeO and a surface of the heat sink is exposed to the outside of the semiconductor power module.

However, Ikeda et al. disclose a semiconductor device comprising a heat sink 130 comprising at least one compound comprising BeO (cover fig., column 3, lines 22-24) in order to provide a good thermal conductivity (column 3, lines 23-24).

Ohno et al. disclose a semiconductor power module comprising: a heat sink 40, the heat sink having an electrically insulating property and thermal conductivity [AlN] (cover fig., column 5, lines 43-45) and wherein a surface of the heat sink 40 is exposed to the outside of the semiconductor module (cover fig., column 5, lines 38-44) in order to provide a good heat dissipation for the semiconductor package device (cover fig.).

Therefore, it would have been obvious to one having ordinary in the art at the time the invention was made to modify the device structure of Hamzehddoost et al. by having the aluminum oxide or the beryllium oxide heat sink and a surface of the heat sink is exposed to the outside of the semiconductor power module because as taught by Ikeda et al. and Ohno et al., such exposing the surface of the heat sink from the

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sealing member is a well known process for providing a good heat dissipation for the semiconductor package (cover fig.).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DiLinh Nguyen whose telephone number is (571) 272-1712. The examiner can normally be reached on 8:00AM - 5:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Hoai v Pham/
Primary Examiner, Art Unit 2814

DLN